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APPLICATION NUMBER: ***60/518,907***
FILING DATE: ***November 10, 2003***

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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53 (c).

Express Mail Label No.	EV 312 070 126	Date of Deposit:	November 10, 2003

INVENTOR(S)

Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
AMJAD	SOOMRO	BRIARCLIFF MANOR, NEW YORK

☐ *Additional inventors are being named on the ____ separately numbered sheets attached hereto*

TITLE OF THE INVENTION (280 characters max)

IEEE 802.11e SCHEDULE BIT INTERPRETATION AT QAP

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ENCLOSED APPLICATION PARTS *(check all that apply)*

☒ Specification *Number of Pages* 10 ☐ CD(s), Number

☐ Drawing(s) *Number of Sheets* ☐ Other (specify)

☐ Application Data Sheet. See 37 CFR 1.76

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT *(check one)*

☐ Applicant claims small entity status. See 37 CFR 1.27.

☐ A check or money order is enclosed to cover the filing fees

☒ The Commissioner is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number: 14-1270

☐ Payment by credit card. Form PTO-2038 is attached.

FILING FEE AMOUNT ($): 160.00

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No.

☐ Yes, the name of the U.S. Government agency and the Government contract number are: ____.

Respectfully submitted,

SIGNATURE _____ Date 10 November 2003

TYPED or PRINTED NAME Aaron Waxler REGISTRATION NO.: 48,027 *(if appropriate)*

TELEPHONE (914) 333-9608 Docket Number: US030443

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

PATENT APPLICATION SERIAL NO. _____

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

11/14/2003 AADDF01 00000059 141270 60518907
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PTO-1556
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Bite

To: iol try/TRY/IPS/PHILIPS@AMEC
cc:
Subject: New Invention Disclosure to be handled, Idnr 779683
Classification:

IPS Helpdesk
ICT/EHV/IPS/PHILIPS@EMEA3
2003-10-10 09:19 PM

This mail is to inform you about a new Invention Disclosure that is assigned to you as Patent Engineer. Below you will find all the information about the Invention Disclosure as well as attached documents and the ID Abstract form.

General data:

ID : 779683
Submission date: 10-Oct-2003

Title

IEEE 802.11e Schedule Bit Interpretation at QAP

Summary

A request by QSTA in Automatic Power Save Delivery mode (APSD) that its traffic be delivered using unscheduled service periods (SP) may not be desirable for a QAP to accept due to potential conflicts with servicing of scheduled traffic by QAP, its service policy or its capabilties. Therefore, the interpretation of the Schedule Bit in IEEE 802.11e draft is modified such that it is up to QAP whether to accept or reject unscheduled SP request by a QSTA in APSD mode.

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Inventors without Philips address

Business e-mail address	*Name*	*Phone*

Invention source

RE Briarcliff Wireless Communications and Networking - Tan [US]

Country of invention

US, United States

Export control number
NLR EAR99

Most relevant business area

Code	*Description*
PS12-08	Networking

Related IDs

For what products/services is the invention intended?
The present invention is applicable to IEEE 802.11e products, systems and applications.

How important is the invention for the intended product(s)/service(s)?
Feature

What is the expected annual market size in five years from now that could use your invention?
$10M to $100M

Will the invention be proposed for an industry standard?
Very likely

Is it possible to detect use of the invention by a competitor?
Fairly easy

Additional information on the importance of the invention.

Details on publications
This invention will disclosed to IEEE TGe meeting scheduled to be held in Melbourne, FL from October 27th till October 30th.

Government and/or university contracts
Type contract

Third party cooperations

Type cooperation	*Name third party*

Relevant projects (Order: Most important first)

Type project	*Name project*
Research	1998-011 - 802.11 WLAN

LRTOs for most relevant Research project

Code	*Description*
LPS	Local and Personal area network Solutions

Additional information: Missing cooperations/projects/LRTOs

ID description

Soomro20031010.do

ID abstract

ID779683.doc

Kind regards,

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Invention Disclosure
Version 2.0.0 21-08-2003

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Title of the invention:
IEEE 802.11e Schedule Bit Interpretation at QAP

Inventors' name(s) + e-mail address(es):
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Abstract of the invention:
(detailed description to be provided on next page)

A request by QSTA in Automatic Power Save Delivery mode (APSD) that its traffic be delivered using unscheduled service periods (SP) may not be desirable for a QAP to accept due to potential conflicts with servicing of scheduled traffic by QAP, its service policy or its capabilities. Therefore, the interpretation of the Schedule Bit in IEEE 802.11e draft is modified such that it is up to QAP whether to accept or reject unscheduled SP request by a QSTA in APSD mode.

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Invention Disclosure
Version 2.0.0 21-08-2003

This template is meant for making a detailed description of your invention off-line. The description can then later be attached in electronic form to your ID submission. You must also use this off-line description to obtain export clearance from your local export-control officer.

Detailed description of the invention

Please describe the invention using the headings below

Background of the invention

Begin the description of the invention with a short discussion of what is already known. If possible, include references to public documents, such as articles in technical journals, proceedings of conferences, brochures, or patent documents.

In IEEE doc:11-03-0698-01-000e by Wilson et. al., presented in IEEE 802.11 TGe task group, it has been proposed that unscheduled service periods (SP) be setup at the request of a QSTA wishing to go into automatic power save delivery (APSD) mode. The document is attached with this disclosure.

Problems or disadvantages overcome by the invention

Usually an invention solves a particular problem or removes some disadvantage of known methods/devices etc. Are the disadvantages/problems new or were they already known?

The request by QSTA for APSD mechanism for unscheduled service periods may not be desirable to be accepted at the QAP due to the fact that a QSTA's request for unscheduled service period may get in conflict with servicing of scheduled service periods. The severity of the conflict depends on the scheduling mechanism at the QAP, the number of scheduled service periods, the number of QSTAs requesting unscheduled service periods, the characteristics of data to be delivered using APSD mechanism, for example.

The essential feature(s) of the invention

The measures/device features that are proposed to solve the problem, and the resulting advantages. If the invention is based on a new understanding (insight), please indicate this.

This invention specifies interpretation of the schedule bit in such a manner that a request by QSTA for APSD mode using unscheduled service periods is considered as advisory by the QAP and the QAP is responsible for the actual mode of delivery to be used for that QSTA. The mode to be used by the QAP is communicated back to the QSTA.

Detailed description of how to build and use the invention

Here all options, alternatives, improvements and enhancements (which we call "embodiments") are described. You should always include at least one fully explained embodiment with all the necessary details. Please add drawings, graphs, test data etc. where appropriate.

Change the proposed text in 11.2.3 of the TGe draft D5.0 as follows:

A non-AP QSTA may signal its desire to utilize APSD as the power-save mode delivery method for individual traffic streams by setting to 1 the APSD sub-field of the TS info field contained in the TSPEC element. The non-AP QSTA

shall request scheduled service periods by sending a TSPEC element that contains a TS Info Field with its Schedule bit set to 1. The non-AP QSTA shall request unscheduled service periods by sending a TSPEC element that contains a TS Info Field with its Schedule bit set to 0. The QAP shall respond with a TS Info Field in TSPEC with the Schedule bit set to 0 or 1 indicating if the QAP will use scheduled or unscheduled service periods when servicing that QSTA. If scheduled service periods are indicated to be used by the QAP then the QAP shall return Schedule element indicating whether the requested wakeup time can be accommodated by the QAP, and if not a new or modified wakeup schedule shall be indicated by the Service Interval and the Service Start Time. ~~The non-AP QSTA shall request unscheduled service periods by sending a TSPEC element that contains a TS Info Field with its Schedule bit set to 0:~~ If unscheduled service periods are indicated to be used by the QAP~~in this case~~ then the QAP shall not return a Schedule element in the response.

The indication by the QAP of the type of service period to be used can also be indicated in a new byte/bytes added to the definition of the TSPEC field.

The indication by the QAP of the type of service period to be used can also be indicated in a new byte/bytes added to the definition of the QoS Control Field.

Applications of the invention

Indicate here in which fields (technical, commercial) the invention can be applied. Please include any references to Philips products or projects relate to the invention.

The present invention is applicable to IEEE 802.11e products, systems and applications.

IEEE P802.11
Wireless LANs
Normative Text for Unscheduled eDCA Power Management

Date: September 12, 2003

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Abstract

This submission contains normative text for the 802.11 TGe draft regarding suggested changes on the power management. Changes are indicated by using underlined text for insertion and ~~strikethrough~~ for deletion.

7.3.2.15 Traffic Specification (TSPEC) element

Instruct editor to add a schedule bit in TS info field. The definition of schedule bit is: for an eDCA flow, if schedule bit is set to 1, the non-AP QSTA requires a schedule. Otherwise, the non-AP QSTA does not require a schedule from the QAP.
Instruct editor to add the table after the schedule bit

APSD bit	Schedule bit	Channel access policy	Description
0	0	eDCA	Legacy
0	1	eDCA	Schedule provided for admitted flow
1	0	eDCA	Unscheduled service period
1	1	eDCA	Scheduled APSD

7.4.1.2 ADDTS response frame format

The ADDTS response frame is transmitted in response to an ADDTS request frame. The frame body of the ADDTS response frame contains the information shown in Table 20.8.

Table 20.8 – ADDTS response frame body

Order	Information
1	Category Code
2	Action Code
3	Dialog Token
4	ADDTS Status Codes
5	TS Delay
6	TSPEC
7 – n	TCLAS (optional)
n + 1	TCLAS Processing (optional)
n + 2	Schedule

The Category code is set to 1.

The Action code is set to 1.

The ADDTS Status code field is defined in 7.3.1.13.

The Dialog Token, TS Delay, TSPEC, TCLAS and TCLAS Processing in this frame are contained in an MLME-ADDTS.response primitive that causes the frame to be sent.

The HC announces the schedule in the ADDTS response frame if the schedule bit in a TSPEC is set to 1.

11.2.1.10 Power management for STAs with TSPEC

STAs with admitted TS having the APSD subfield of the TSInfo field set to 1 may go into power-save after an SP ends, until the beginning of the next SP. The QAP shall buffer MSDU and management frames that are addressed to the non-AP QSTA and arrive after the non-AP QSTA using APSD mechanism has gone to sleep, and delivers these frames when the next SP starts, using a prioritized or parameterized delivery mechanism.

A SP can be either scheduled or unscheduled. An unscheduled SP begins when the QAP receives any frame from the non-AP QSTA and ends after the QAP has attempted to transmit all frames destined for the non-AP QSTA. A scheduled SP starts at fixed intervals of time specified in Minimum Service Interval field. The first scheduled SP starts when the low order 4 bytes of the TSF timer equals the value specified in Start Time field. A non-AP QSTA using APSD mechanism shall first wake up to receive downlink frames buffered and/or polls from the AP/HC. The station shall wake up subsequently at a fixed time interval equal to the Minimum Service Interval. The QAP may modify the Service Start Time by indicating so in the Schedule element it sends in response to the TSPEC request.

The station shall wake up at a subsequent time whenever

(TSF - Service Start Time) mod Minimum Service Interval = 0.

11.2.3 Automatic Power-Save Delivery (APSD) in a QBSS

QAPs capable of supporting automatic power-save delivery (APSD) shall signal this capability through the use of the APSD subfield in the Capability Information Field in Association Request management frame.

Non-AP QSTAs operating in a QBSS wishing to utilize the automatic power-save delivery mechanism shall inform the AP by setting the APSD subfield of the TS info field in the TSPEC element to 1. The QAP shall not arbitrarily transmit MSDUs to non-AP QSTAs that use APSD, but shall buffer MSDUs and only transmit them during the service period. A scheduled service period begins at the scheduled wakeup times that correspond to the Service Interval and the Service Start Time indicated in the Schedule element sent in response to a TSPEC. An unscheduled service period begins when the QAP receives any frame from the non-AP QSTA.

Non-AP QSTAs use the power management field in the frame control field of a frame to indicate whether it is in active or power-save mode. The QAP uses the power-save delivery mechanism currently in effect for a non-AP QSTA to deliver frames to the non-AP QSTA when it is operating in power-save mode.

A non-AP QSTA may signal its desire to utilize APSD as the power-save mode delivery method for individual traffic streams by setting to 1 the APSD sub-field of the TS info field contained in the TSPEC element. The non-AP QSTA shall request scheduled service periods by sending a TSPEC element that contains a TS Info Field with its Schedule bit set to 1. The QAP shall respond with a Schedule element indicating whether the requested wakeup time can be accommodated by the QAP, and if not a modified wakeup schedule shall be indicated by the Service Interval and the Service Start Time. The non-AP QSTA shall request unscheduled service periods by sending a TSPEC element that contains a TS Info Field with its Schedule bit set to 0; in this case the QAP shall not return a Schedule element in the response.

APSD shall only be used to deliver unicast frames to a QSTA. Broadcast/multicast frame delivery shall follow the frame delivery rules defined for broadcast/multicast frames as defined in clause 11.2.1.4.

11.2.3.1 Transmit operation at the QAP

QAPs that implement and signal their support of APSD shall maintain an automatic power-save delivery (APSD) and an access policy status for each currently associated non-AP QSTA that indicates whether the non-AP QSTA is presently using APSD, and the schedule (if any) for the non-AP QSTA. A QAP implementing APSD shall, if a non-AP QSTA is using APSD, temporarily buffer the MSDU or management frames destined to that non-AP QSTA. MSDUs and management frames received for non-AP QSTAs not using APSD shall follow the appropriate frame delivery rules as related to their respective power-saving mode.

a) MSDUs, or management frames, destined for APSD capable non-AP QSTAs shall be temporarily buffered in th QAP when requested by the non-AP QSTA. The algorithm to manage this buffering is beyond the scope of this standard, with the exception that the QAP must preserve the order of arrival of frames on per TID, per station basis. The algorithm to manage this buffering shall not favor the transmission of buffered frames destined for non-AP QSTAs using APSD mechanism over the transmission of frames destined for non-AP QSTAs not using APSD.

b) At every beacon interval, the QAP shall assemble the partial virtual bitmap containing the buffer status per destination for non-AP QSTAs using APSD, and shall send this out in the TIM field of the beacon. While sending this indication in the beacon is not essential for the operation of APSD, it simplifies the construction of TIM field at the AP. If a non-AP QSTA has set up a scheduled SP, then the QSTA automatically transitions to active mode at each SP. Therefore, the QAP shall transmit all frames buffered for the non-AP QSTA following a scheduled SP. If the non-AP QSTA has set up unscheduled SPs, the QAP shall buffer frames until it has received a frame from the non-AP QSTA , which indicates the start of an unscheduled SP.

c) At each APSD SP for a non-AP QSTA, the QAP shall attempt to transmit all frames destined for the non-AP QSTA. The More Data bit of the directed data or management frame shall be set to 1 to indicate the presence of more frames

that are destined for that non-AP QSTA. For all frames except for the final frame of the SP, the EOSP subfield of the QoS Control field of the QoS data frame shall be set to 0 to indicate the continuation of the SP. A QAP may also set the More Data bit to 1 in a QoS+CF-Ack frame in response to a QoS Data frame to indicate that it has one or more pending frames buffered for the target station identified by the RA address in the QoS+CF-Ack. The QAP considers APSD QSTA to be in "active" mode after it has sent a QoS+CF-Ack, with the More Data bit set, to the APSD QSTA. If necessary the QAP may generate an extra (QoS)-Null frame, with the more data subfield set to 0 and the EOSP set to 1. When the QAP has transmitted a directed frame to the non-AP QSTA with More Data subfield set to 0 or the EOSP subfield set to 1 during the SP, it shall not transmit any more frames using this mechanism until the next SP .

d) A QAP shall have an aging function to delete pending traffic when it is buffered for an excessive time period. Aging may be based on the listen interval specified by the non-AP QSTA in the (re)association request.

e) Whenever a QAP is informed that an APSD capable non-AP QSTA changes its delivery mode to not be APSD mode, then the QAP shall send buffered MSDUs and management frames (if any exist) to that non-AP QSTA according to the rules corresponding to the current power-save mode of the non-AP QSTA.

f) A QAP that receives a PS-Poll from a non-QAP QSTA using APSD shall follow the frame delivery rules as defined in clause 11.2.1.4, item f.

11.2.3.2 Receive operation for non-AP QSTAs using APSD

A non-AP QSTA using APSD shall operate as follows to receive an MSDU or management frame from the QAP:

a) If a scheduled SP has been set up, the non-AP QSTA transitions to Active mode at its scheduled Start Time.(A non-AP QSTA shall wake up early enough to receive transmissions at the scheduled SP.)

b) If the non-AP QSTA is initiating an unscheduled SP, the non-AP QSTA transitions to Active mode and transmits a frame to the QAP.

c) The non-AP QSTA shall remain awake until it receives a directed MSDU or management frame with the More Data subfield set to 0, a QoS frame with the queue size subfield of the QoS Control field set to 0, a QoS frame with the EOSP subfield in QoS Control field set to 1, or a beacon with its TIM bit cleared.

d) If an APSD QSTA receives a QoS+CF-Ack from its parent QAP, with the More Data bit set, the APSD QSTA shall remain awake until it receives a directed MSDU or MMPDU frame with the More Data field cleared, or it receives a beacon with its TIM bit cleared. If a QSTA using APSD does not receive an expected ACK or QoS+CF-Ack for a directed MSDU or MMPDU, then it shall assume that the More Data bit was set to 1.